

Given:

1. Determine the maximum weight W that can be supported in the position shown if each cable AC and AB can support a maximum tension of 600 lb before it fails.

Sol'n $\sum F_x = 0$ for equilibrium

$$\sum F_x = 0; \frac{5}{13} F_{AB} - \sin 30^\circ F_{AC} = 0$$

$$F_{AC} = \frac{5}{13} F_{AB}$$

$$F_{AC} = 0.3846 F_{AB}$$

$$\text{So } F_{AB} > F_{AC}, \text{ let } F_{AB} = 600 \text{ lb}$$

$$\sum F_y = 0; F_{AC} \cos 30^\circ + F_{AB} \frac{12}{13} - W = 0$$

$$\text{Substituting } 0.3846(600 \text{ lb}) \cos 30^\circ + 600 \left(\frac{12}{13} \right) = W$$

$$\therefore W = 953.55 \text{ lb.}$$

$$\underline{W_{\max} = 954 \text{ lb}}$$

Find: W_{\max} .Given:

2. A force of $F = \{-40 \mathbf{k}\}$ lb acts at the end of the pipe. Determine the magnitudes of the components F_1 and F_2 , which are directed along the pipe's axis and perpendicular to it, as shown.

Find:Sol'n.

$$F_1 = \hat{u}_{OA} \cdot \vec{F} = F_{//OA}; \sqrt{F_{//OA}^2 + F_{\perp OA}^2} = F$$

$$\hat{u}_{OA} = \frac{\vec{r}_{OA}}{|\vec{r}_{OA}|}$$

$$\vec{r}_{OA} = (3\hat{i} + 5\hat{j} - 3\hat{k}) \text{ ft}$$

$$\hat{u}_{OA} =$$

$$|\vec{r}_{OA}| = \sqrt{3^2 + 5^2 + 3^2}$$

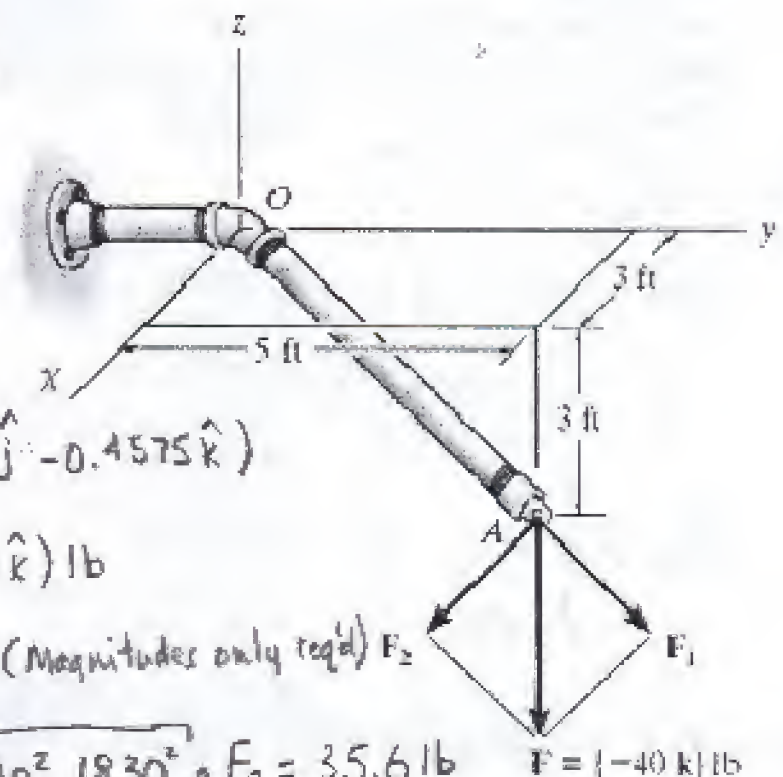
$$|\vec{r}_{OA}| = 6.557 \text{ ft}$$

$$\hat{u}_{OA} = \frac{3\hat{i} + 5\hat{j} - 3\hat{k}}{6.557} = (0.4575\hat{i} + 0.7625\hat{j} - 0.4575\hat{k})$$

$$F_{//OA} = (0.4575\hat{i} + 0.7625\hat{j} - 0.4575\hat{k}) \cdot (-40\hat{k}) \text{ lb}$$

$$F_1 = F_{//OA} = +18.30 \text{ lb directed // to OA (Magnitudes only req'd)} \quad F_2$$

$$F_2 = F_{\perp OA}; \quad F_2 = \sqrt{F^2 - F_1^2}; \quad F_2 = \sqrt{40^2 - 18.30^2}; \quad \underline{F_2 = 35.6 \text{ lb}}$$



Find:

3. Determine the magnitudes of F_1 , F_2 and F_3 for equilibrium of the particle.

Sol'n $\sum F_x = 0$; $\sum F_y = 0$; $\sum F_z = 0$ for equilibrium

F_2 along z axis is $F_2 \hat{k}$

F_3 along $-y$ axis is $-F_3 \hat{j}$

For 150 lb $F_x = 150 \cos 45^\circ \cos 30^\circ$

$$F_{2x} = (91.85 \hat{i}) \text{ lb}$$

$$F_y = -150 \cos 45^\circ \sin 30^\circ =$$

$$F_y = (-53.03 \hat{j}) \text{ lb}$$

$$F_z = 150 \sin 45^\circ = (106.07 \hat{k}) \text{ lb}$$

For 225 lb force $(-225 \hat{i}) \text{ lb}$ applies

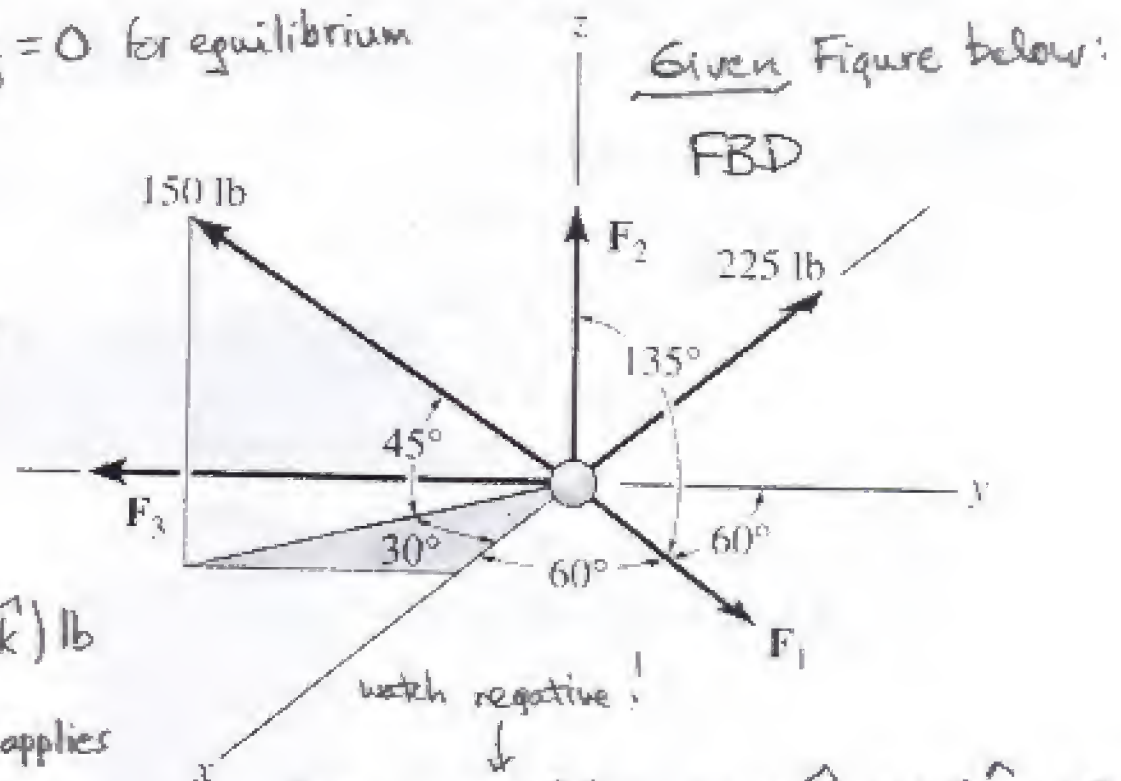
Components of F_1 are $F_1 \cos 60^\circ \hat{i} + F_1 \cos 60^\circ \hat{j} + F_1 \cos 135^\circ \hat{k} = 0.5 F_1 \hat{i} + 0.5 F_1 \hat{j} - 0.7071$

Write $\sum F_x = 0$; $-225 \hat{i} + 91.85 \hat{i} + 0.5 F_1 \hat{i} = 0$, So $F_1 = 266.3 \text{ lb}$.

Write $\sum F_y = 0$; $-F_3 \hat{j} + 266.3(0.5) \hat{j} - 53.03 \hat{j} = 0$; So $F_3 = 266.3(0.5) - 53.03 = 80.1$

Write $\sum F_z = 0$; $F_2 \hat{k} - 266.3(0.7071) \hat{k} + 106.07 \hat{k} = 0$; $F_2 = 82.23 \text{ lb}$.

Rounding Values $F_1 = 266 \text{ lb}$, $F_2 = 82.2 \text{ lb}$, $F_3 = 80.1 \text{ lb}$ as shown on

Given:

4. An object traveling parallel to the x -axis strikes the block, as shown, 9 m above ground level, with a force of 100 N. Calculate the moment developed about the origin, expressing it as a Cartesian vector.

Find:

Sol'n $\vec{M}_O = \vec{r} \times \vec{F}$

$$\vec{r} = (4 \hat{i} + 9 \hat{j} - 2 \hat{k}) \text{ m}$$

$$\vec{F} = (-100 \hat{i}) \text{ N}$$

$$\vec{M}_O = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 4 & 9 & -2 \\ -100 & 0 & 0 \end{vmatrix} \text{ N}$$

$$\vec{M}_O = 0 \hat{i} - [(4)(0) - (-2)(-100)] \hat{j} + [(4)(0) - (9)(-100)] \hat{k}$$

$$\vec{M}_O = \{+200 \hat{j} + 900 \hat{k}\} \text{ Nm}$$

